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Safety management systems in aviation operations in the United States: Is the return on investment worth the cost?

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The economic benefits of safety programs in aviation operations in the United States are undeniable. Making a strong business case for these programs is not easy, since safety is not tangible until there are accidents and incidents. Safety Management System (SMS) is an organized approach to a systemic safety improvement and challenges the safety professional to quantify the return on investment from safety programs. The economic impact of safety occurrences on aviation operations is explored. An analysis of case study models and the financial merits of implementing proactive safety initiatives like SMS in a collegiate aviation program are explored. The outcome of the study shows that SMS as an investment portfolio has varying rates of return on investment, but overall highly positive for operations. It is envisaged that these case study models would help aviation safety professionals present a clear and strong financial case to aviation top management.

Key words: Safety, management, system

INTRODUCTION

The International Civil Aviation Organization (ICAO) expects the member states to achieve Safety Management System (SMS) compliance for all certificated aviation operators, which includes airlines, repair stations, airports and aviation training organizations (ICAO, 2009). In the United States, the Airline Safety and Federal Aviation Extension Act of 2010 (Pub. L. 111-216) directed the Federal Aviation Administration (FAA) to issue a final rule on Safety Management System (SMS) for Part 121 operators by July 30, 2012 (US Federal Register, 2011).

The final rule will "require all Part 121 air carriers to implement a safety management system." Some air carriers could face implementation challenges through the cost in the initial development and documentation of their SMS (FAA, 2010a). There would also be recurrent operating costs to include the modification or purchasing of new equipment/software, additional staff, promotional materials, and training (FAA, 2010a).

The FAA estimates that for a small carrier, with less than 9 aircraft, compliance would cost $253,500 per year for the first three years and then roughly $233,000 per year for subsequent years (FAA, 2010b). For medium sized carriers, that have 10 to 49 aircraft, but still have less than 1,500 employees the compliance cost would be $342,450 per carrier per year for the first 3 years and then $222,500 every years after (FAA, 2010).Some aviation stakeholders may be of the opinion that SMS would not require any additional staffing or financial commitment. On the contrary many air carriers and especially collegiate aviation programs will have to prioritize and apportion adequate resources from their operating budget to include implementing and managing an SMS. (Wood, 2003). From a business point of view it would be a clear juggling act of balancing safety and profitability (ICAO, 2009).

In the case of some airlines, there are existing processes and programs in place that can help to reduce the cost of implementation, and meet the regulatory requirements of a fully functional SMS (ICAO, 2009). The Aviation Safety Action Program (ASAP), Flight Operational Quality Assurance (FOQA), and The Internal Evaluation Program (IEP) are some of the programs that can be modified to suit the size and complexities of the carrier in terms of proactive and predictive safety risk management, while at the same time effectively sustaining the SMS process of continuous safety improvement (FAA, 2010) .

Shifting an airline's mindset from reactive to proactive safety requires not only a set of safety audit tools (such as ASAP or FOQA), but also a full endorsement from upper management to establish a program with adequate resources and personnel committed to focusing on the humans and their work processes (Transport Canada, 2008). The airlines must embrace the initial investment in safety and work towards a phased SMS implementation process (IATA, 2011).

There would be the need to realign staffing and human resource requirements by getting dedicated SMS process personnel (preferably safety staff) and required logistics to co-ordinate the implementation phase (United States Airforce, 2004). There would also be the need to train personnel to fill the role as SMS advocates at the departmental level (Wood,2003). These advocates may be line pilots, customer service representatives, ground handling personnel and engineers who are already saddled with their organic roles and responsibility in the airline and school (Bos, 2007).

Normally the most effective means of getting SMS focal persons to be dedicated to the task of coordinating the implementation phase of the SMS is to include it in their job description and role (Stolzer, 2008).There may be the need to relieve them of other duties to concentrate on the task of implementing the SMS. This action can affect other sectors in the organization in terms of manpower and economic output (Damon, 2011). SMS recognizes the need for an equitable management of productivity and protection of resources. (ICAO, 2009).

Developing a model to show the investment benefit of SMS implementation and sustainment versus the costs of developing the program is not an easy undertaking (Damon, 2011). In such models, one must also account for the costs of non-implementation of SMS, which can be realized from direct and indirect cost associated with incidents and accidents (Transport Canada, 2005). The model should be built around the concept that the large costs associated with accidents could be reduced or avoided with the implementation of a safety management system (Lercel, 2011). This reduced or avoided costs could then be seen as a net gain and placed into a Return on Investment (ROI) model for safety management system investment calculations (Lercel, 2011).

The macro level costs of an aircraft hull loss and its effect on the stock prices of some airlines would be examined, since there is quite a substantial amount of data available in their operations. The stock performance of these airlines would be analyzed during the twelve month period following a major accident with the aim to demonstrate the severe impact accidents can have on an aviation service provider like an airline. Another case study would then analyze the economic effect of an incident and accident on an accredited aviation training organization (Part 141) operations using a cost benefit analysis and return on investment (ROI) model developed by Lercel et al (Lercel,2011).

Literature Review

While there is a wealth of literature regarding cost-benefit analysis in high risk industries, there is little literature that directly addresses such analyses in aviation safety systems (Lercel, 2011). Regulatory guidance acknowledges the appropriateness of a business management approach to safety (ICAO, 2009), and further insists that such analyses should be performed to predict the economic impact of such activity on the businesses tasked to do it (FAA, 2010). General information on aviation economics and the current state of cost assignment into different departments of aviation businesses is readily available, and it addresses such topics as airline metrics (Vasigh, 2008) costs specific to aircraft operation (Wensveen, 2011) and cost accounting categories (Vasigh, 2010).

A review of cost-benefit analyses as applied to other high consequence industries has produced insight into cost-benefit analysis of proactive accident prevention programs and their effect on injury rates in the aviation industry (Cox, 2011), the cost of safety capital and operating expense (CAPEX, OPEX, respectively) in the Process Industry (Lercel, 2011) and incident- specific costs, direct and indirect (CASA, 2009).The Australian government has provided definitions of the terms associated with various methods of cost-benefit analysis (Net Present Value (NPV), Discounted Cash Flow (DCF), Internal Rate of Return (IRR) and Sensitivity Analysis, etc.) for its own Civil Aviation Safety Authority (CASA, 2009)

The perspective of the management of safety as an organizational process and of safety management as a core business function clearly places ultimate safety accountability and responsibility for such function at the highest level of aviation organizations (IATA, 2011)(without denying the importance of individual safety responsibility for the delivery of services). Nowhere are such accountability and responsibility more evident than in decisions regarding allocation of resources (ICAO, 2009). Piers (2009) alluded to the fact that the resources available to aviation organizations are finite and Cox (2011) agrees with him that there is no aviation organization with inexhaustible resources.

Resources are essential to conduct the core business functions of an organization that directly and indirectly support delivery of services (Mahadevan, 2010). Resource allocation therefore becomes one of the most important, if not the most important, of the organizational processes that senior management must account for (Wensveen, 2011).Unless the perspective of safety management as a core business function is adhered to by the organization, there is the potential for a damaging competition in the allocation of resources to conduct the

Table 1: Benefits and Cost of SMS implementation. Source: US Federal Register

Total Benefits and Costs per Year for All Part 121 Carriers
(Millions of dollars)

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Benefits	$0.0	$0.0	$0.0	$67.2	$67.2	$67.2	$67.2	$67.2	$67.2	$67.2	$67.2
Present Value	$0.0	$0.0	$0.0	$47.9	$44.8	$41.9	$39.1	$36.6	$34.2	$31.9	$29.9
Costs	$56.3	$56.3	$56.3	$33.2	$30.4	$33.2	$30.4	$33.2	$30.4	$33.2	$30.4
Present Value	$49.2	$45.9	$42.9	$23.7	$20.3	$20.7	$17.7	$18.0	$15.5	$15.8	$13.5
Year	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**Total**	
Benefits	$67.2	$67.2	$67.2	$67.2	$67.2	$67.2	$67.2	$67.2	$67.2	$1,143.1	
Present Value	$27.9	$26.1	$24.4	$22.8	$21.3	$19.9	$18.6	$17.4	$16.2	$500.8	
Costs	$33.2	$30.4	$33.2	$30.4	$33.2	$30.4	$33.2	$30.4	$33.2	$710.8	
Present Value	$13.8	$11.8	$12.0	$10.3	$10.5	$9.0	$9.2	$7.9	$8.0	$375.5	

core business functions that directly and indirectly support delivery of services (Wald, 2010).

Similarly, an FAA-requested report (FAA 2007) provides analysis of key economic values, often called "critical" values, used in the conduct of benefit-cost and other evaluations of investments. These include even esoteric cost items such as the value of time lost by waiting travelers, whether on personal or company business (Cox, 2011). The purpose of this paper is to provide an outlook into the potential round-up of SMS expenses and the subsequent financial benefits attributable to the investment in SMS of both material and manpower in a collegiate aviation program. It is based on the simple premise that it is a better to allocate substantial financial and human resources to a collegiate aviation safety program like SMS, which will prevent or reduce accidents than to forego SMS and absorb the financial impact of accidents that could have been avoided.

A major benefit of effective safety interventions is avoiding costs associated with safety incidents which otherwise may have happened without such action (FAA, 2010b). SMS implementation will inure to the benefit of Part 121 airlines and Part 141 collegiate aviation in the form of value of averted casualties, aircraft damage, and accident investigation costs by identifying safety issues and spotting trends before they result in a near-miss, incident, or accident. (IATA, 2011a). A real challenge is that, historically, safety professionals have struggled with determining a return on investment of such programs that avoid safety related costs (Lercel, 2011).

Implementation and Compliant Cost of SMS in Part 121 Airline Operations

The FAA projects that the compliance cost supporting each component would come from the initial development and documentation of the SMS, implementation and continuous operating costs to include the modification or purchasing of new equipment/software, additional staff and promotional materials, and training (FAA,2010). Because SMS is inherently scalable, costs depend on the size of the carrier and the type of operations that it provides (FAA, 2010). Further, operators may have existing quality management systems or other voluntary programs, which may lower the estimated compliance costs (Stolzer, 2008).

These components would also help air carriers effectively integrate formal risk control procedures into normal operational practices thus improving safety for all U.S. part 121 operators (FAA, 2012). Total benefits are estimated at $1,143.1 million ($500.8 million present value) and total costs are estimated at $710.8 million ($375.5 million present value) (FAA, 2010a) as shown in table 1.

Macro Level Cost –Benefit of SMS – An Analysis

SMS creates benefits by preventing major accidents that threaten an organizations entire market value (CASA, 2009). Even before the cascade of indirect costs resulting from a large-scale accident or incident - loss of available seats, loss of personnel, work time loss among personnel, morale, reputation, etc. catastrophic incidents and accidents may produce large direct costs, such as a "hull loss," (destruction of the airframe and its component parts), loss of life or injuries, or other physical damage to facilities and property on the ground (ICAO, 2009).

The analysis will look at three major air carrier and one regional carrier accidents resulting in hull losses. The accidents also contributed to declines in the stock, market values and bankruptcy of some of the airlines. These accidents occurred on 31 January 2000 (Alaska Airlines Flight 261) (NTSB, 2003), 12 November 2001 (American Flight 587) (NTSB, 2004), 15 January 2009 (USAir Flight 1549, the so-called "Miracle on the Hudson") (NTSB, 2010), 12 February 2009 (Colgan Air Flight 3407) (NTSB, 2010)

In the first three cases, parent company stock prices dropped following these accidents measured at one, three, six, and twelve months after the accident,

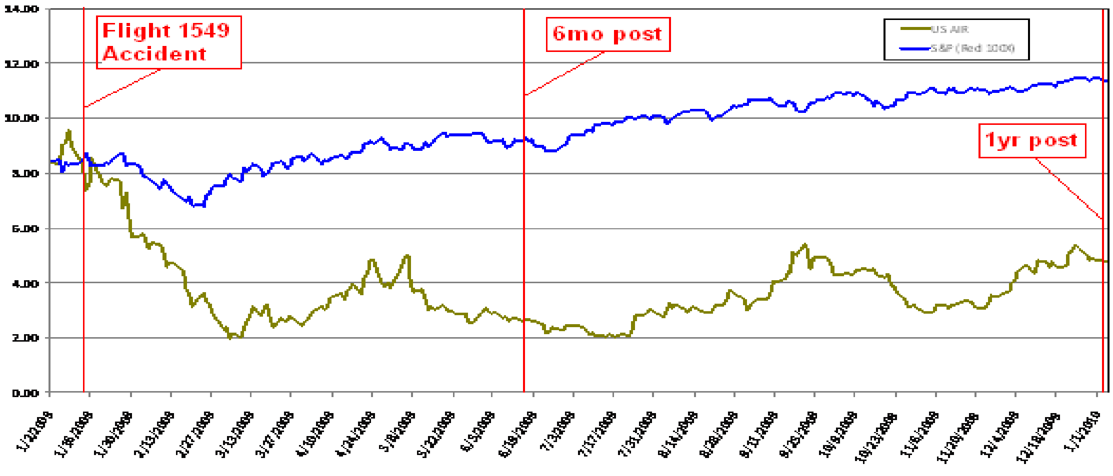

Figure 1. USAir ways Stock performance compared to the S&P 500 Index for the 12-month period following the accident of USAir ways Flight 1549, 15 January 2009.
Source: http://www.marketwatch.com/investing/stock/lccs

suggesting a correlation between the accidents and the losses of stock value. (Evans, et al, 2010). In the case of Colgan Air, the accident had severe economic impact on the parent company called Pinnacle Corporation. The stocks share price for the corporation, declined from approximately to $20 per share in 2007 to $0.30 per share on April 10, 2012 (Skonieczny, 2012). This showed a decline of almost 100 percent and resulted in the eventual filing of bankruptcy by Pinnacle (WSJ, 2012).

It is notable that US Airways, despite being in potentially the least vulnerable position due to no loss of life and the glowing press coverage that ensued, turned in results far below an index of other airline stocks, underperforming their competitors by as much as 154% at one point (Damon, 2011) as depicted in figure 1. A loss of over 25% of its market value represents a loss of $328,000,000 in capital for US Airways, or, expressed in other terms, the equivalent cost of four more of the same type Airbus 320 aircraft lost in the accident (Airbus, 2008).

Micro-level analysis of sms implementation in a collegiate aviation program

The micro-level analysis requires the use of examples from actual actions taken at aviation organizations. It also requires the identification not only of costs associated with SMS, but also the costs associated with an incident or accident that most likely would have occurred if no appropriate SMS program were in effect.

Case study one: Change management and safety investment

To demonstrate this method of identifying and collecting SMS-related costs and calculating the financial benefits of SMS mitigation, let us examine an event from an aviation training organizations, which has an accredited Part 141 aviation program and had just changed training aircraft. The program used Piper® Warriors and Cherokee for the commercial aviation program for a long time and due to expansion and standardization of fleet, decided to switch to new 2012 Cessna® 172 SP with technically advanced cockpit instrumentation (Garmin® 1000). As part of the investment in operational capacity, the program decided to have a Flight Data Monitoring Program (FDM), with the aim to collect operational data on flight exceedences. This resulted in the installation of FDM instruments and cockpit voice recorders in some of the fleet.

An FDM program and team is set up to use the information derived from the monitors to identify trends and critical deviations from standardized parameters that occur during training events. The aim is to establish a proactive safety risk management system in the flight training program. The cost of maintaining the FDM program per year is about $60,000 in terms of labor and technical support (Higgins, 2012). A series of hard landings are picked up by the FDM sensors on board these new training aircraft. These landings are not reported by the flight crew. Initial data analysis reveals that there have been hard landings on four of the new aircraft. These trends poses a serious risk to the safety of operations and the Director of Safety and the Safety Department promptly conducts an in-house investigation and finds out that there is a training gap for both instructors and students alike in the new aircraft, due to massive power reduction on approach to a specific runway at the training airport, due to high tailwind conditions at the threshold. This creates both low power

Table 2: Maintenance Occurrence Example Summary

SMS Line Item Expenses:	Maintenance Occurrences
Incident Type	During maintenance, detached wiring harness and connector left in door hinge are destroyed and structure damaged when door closed for aircraft painting.
Number of Occurrences	4
Cost per Occurrence	$27,000
Total Cost	$108,000

and excessive pitch handling scenarios for students, who end up with high flare, low speed and heavy touchdown.

The Directors of Flight Operation, Maintenance and Training are informed and an inspection is carried out on all the new aircraft and also top -up training is conducted for flight instructor. New Standard Operation Procedures (SOPs) are developed for tail wind landing in the new fleet on that particular runway. The $60,000 investment in FDM has yielded proactive risk mitigation and both assets and human resource has been secured. In the absence of the FDM program, there is the likelihood of an incident or even accident, the loss of crew will be irreplaceable and the hull loss of even a new Cessna 172 with advanced instrumentation at a price of $307, 500, (Cessna Aircraft Company, 2012) the return on investment per aircraft can be calculated as follows Assuming four aircraft of that type are serviced per year, the ROI calculation for avoiding just one incident is:

Return on Investment (ROI) = (Payback – Investment) ÷ Investment.

Payback = The cost of the hull loss of one new 2012 Cessna 172SP.

Investment = The cost associated with the FDM program and other proactive SMS program, that gave early warning for further catastrophic accidents to be prevented.

(307,500 – 60,000) ÷ 60,000 = 4.125 per aircraft

The university can accrue about 413% of return on investment per aircraft for running the FDM safety program. This shows that in a year, for a collegiate aviation program with such devices installed in trainers, it would be a worthwhile investment. This is just the quantitative savings from the ROI calculation, since an accident or incident will also have other variables, like insurance payouts, citations and fines from the FAA, cost of clean-up of accident site and salvage etc. The uninsured cost of loss of reputations, low morale of personnel, and time for investigations and clean up cannot be quantified in figures.

Case study two: Maintenance occurrences

In a second hypothetical event, an aircraft manufacturer released a mandatory Service Bulletin (SB) involving the locking mechanism of the main entry door which has to be performed at the aircraft next major maintenance event by a third party vendor for the collegiate aviation fleet. The work required that the electrical connector from the airframe to the door be disconnected. This disconnect is located in the hinge area of the door. When these aircraft were in for major maintenance, most often it also included a new paint job. The SB required parts which themselves required a long lead-time, and there was an extended period of idle time with the door disassembled for long periods.

Because painting of the aircraft was also scheduled during this maintenance operation, the aircraft was scheduled for paint during the middle of the maintenance cycle, which meant the door would need to be closed for painting. Unfortunately, the electrical harness and connector were not reconnected prior to closing the door, and the harness and connector were caught in the hinge area. The damage was significant, leading to the removal of the door, structural repairs, new harness, new connector, production hours, engineering hours, lead time on parts, and schedule delays.

Safety mitigation process

After such an incident, the responsible line manager would complete the necessary incident reports, notify the safety department, investigations will be carried out and the needed remedial action taken. It may require retraining and risk management processes for the maintenance employees and extensive safety education. Nonetheless, this type of error happened three more times before the recurring problem was identified. The maintenance department of the collegiate program did not have a process or system in place to enable employee reporting or hazard identification. If such systems had been in place this problem likely would have been identified sooner and future occurrences avoided. It was estimated that the average cost per incident was $27,000 with these four events costing the university a total of $108,000 (see table 2).

Cost of safety intervention

Once this was identified as a recurring problem, a team of five employees were assembled to develop a long term fix. Team members included representatives from the maintenance, avionics, quality, and engineering departments. The team found that the wire harness routed under the entryway floorboard had an additional disconnect just under the floor. By removing the floor board and disconnecting the other end, the entire harness could be removed from the aircraft thus eliminating the hazard. The team met over a two week

Table 3: Maintenance Occurrence Example Corrective Action Costs

Team for Corrective Action	Hours Utilized	Cost/Hr.	Cost per Hours Employee
Maintenance Rep	4	$65	$260
Avionics Rep	4	$65	$260
Quality Rep	4	$65	$260
Engineering Rep	4	$65	$260
Total Development Cost			$1040
Corrective Action	Detach wiring at two connectors and remove the entire assembly from under a floorboard. .		
	Hours Utilized	Cost/Hr.	Total
Corrective Action Cost per Aircraft	6	$65	$390
Corrective Action Cost (4each) aircraft)			$1560
Total Corrective Action Cost = Total Development Cost + Corrective Action (4 aircraft)			$2600

period and developed a fix which included a documented process with employee sign-offs. The total time spent developing the fix was 16 hours. At an average compensation of $65 per hour, the development of this solution came to $1040 (table 3).

The additional hours to remove and reinstall the floor board and harness resulted in an addition to the cost of maintenance of six hours at $65/hour or $390.The total cost of assembling a team of employees to carry out some basic functions of Safety Management Systems - risk assessment, risk analysis, mitigation development, and mitigation implementation was $1,040, plus an additional $390 per aircraft serviced. In the simplest of terms, the university's action of assembling a committee to investigate and develop a solution to the wiring harness/door hinge problem is a $1430 fix for a $27,000 problem. Assuming four aircraft of that type are serviced per year, the ROI calculation for avoiding just one incident is:

Return on Investment = (Payback – Investment) ÷ Investment or: ROI = ($27,000 – $2,600) ÷ $2,600. The university will make 938% ROI for the safety interventions.

Calculating multiple sms investments in an aviation organization

Calculating the true value of a Safety Management System to an aviation organization such as an airline and collegiate aviation program is a very complex endeavor (CASA, 2009). The operational costs are high and the hierarchy of spending controls diverse within such an organization, coupled with the search for synergy as these airlines and collegiate aviation programs, in implementing SMS across their various operations creates overlapping jurisdictions and shared expenses (Cox, 2011).

A vast number of SMS expenses are credited to indirect and overhead costs that are not easily identified as SMS-related cost drivers. Nonetheless, once accomplished, an organization-wide safety ROI - naturally, with different values from area to area - may be thought of in terms of an investment portfolio consisting of multiple safety programs with varying rates of return, risk, and maturity terms. This allows safety professionals to present the financial case more clearly to the top management, and of course, the President of such universities.

Investment in sms- positive business attributes

The initial and recurrent investment in SMS will not only assist collegiate aviation programs to accomplish their mandatory regulatory responsibilities as required by the oversight entity (FAA), but will definitely provide significant business benefits. ICAO SMS Manual comprises internal appraisal and quality assertion concepts that can result in more controlled management and continuous improvement of operational processes (ICAO, 2009). The SMS outlined in the ICAO SMS Manual is designed to allow incorporation of safety efforts into the operator's business model and to assimilate other systems such as quality, occupational safety, and environmental control systems that operators might already have in place or might be considering (IATA, 2011). It has been reported that operators who have integrated SMS into their business models benefits from them financially as well (Damon, 2011). The collegiate aviation programs stand to gain positively through the following:

a. Stability, safety and customer support – customers are aware some operations are safer than others.

b. Possible reduction in insurance premiums through demonstration of control of safety risks.

c. Good work/life balance practices, for example adjustment of rosters to avoid most tiring shift/sector will give safety benefits, and can also improve employee/student morale – potentially lowering employee turnover and reducing training costs.

d. A proactive approach to safety can be demonstrated with documented evidence in the event of an incident or accident.

Productivity and investment in sms

Through a good investment and successfully implemented SMS, collegiate aviation programs will have better compliance with regulations and other mandatory operational requirements (FAA, 2010). This will in turn minimize the adverse consequences of any safety occurrences (Wood,2003). Additionally, it will allow students and employees to identify potential hazards that may jeopardize their health and safety (Manuele, 2011). More importantly, SMS will have positive impacts on personnel by creating trusts, increased morale which leads to better performance (Lercel, 2011). SMS will definitely help an organization to prevent catastrophic accidents and ensure safer operations (Wood, 2003). An additional benefit of SMS is the attraction of more students and training contract which would reap potential financial benefits (FAA , 2012).

Adverse effect of inadequate investment in SMS by Aviation Service Providers

Failure to invest in SMS can lead to both operational and financial loss (Global Aviation, 2012). A critical assessment of the direct and indirect costs of an incidence/ accident shows that the consequences are unlikely to be appreciated(Damon,2011) .Usually the worse scenarios are the indirect costs as they are more difficult to assess, these are often not covered or fully compensated by the company's insurance (ICAO, 2009). This includes items like:

a. Loss of business and reputation.
b. Legal fees and damage claims.
c. Medical costs not covered by workers' compensation.
d. Cost of lost use of equipments (loss of income).
e. Time list by injured persons and cost of replacement workers.
f. Increased insurance premiums.
g. Aircraft recovery and clean-up.
h. Fines and Citations.

The Future of SMS Investment for Airlines and Collegiate Aviation Programs

As the national and global demand for pilots has been forecasted to shoot up, there would be more training from aviation training providers like the colleges and university aviation programs (Boeing , 2012). With the recent emphasis on professionalism and solid academic credentials for the next generation pilot by the FAA and NTSB, training in SMS and risk management will serve as an added impetus, to the collegiate aviation graduate (NTSB, 2012). It is however a reality that the cost of flight training will not reduce and it will always be a financial challenge for both students and the training providers (Gubisch, 2011). Ultimately the direct beneficiaries of professional, safe and competent pilots are the airline operators like Part 121 carriers.

Aviation has become inherently safe in recent times and flight training, with all the risk of maneuvers that must be accomplished as part of training makes it very imperative to invest in proactive safety (FAA , 2012). Will aviation training become so safe that further improvements to safety will lack sufficient value financially to be implemented? In other words, can senior management justify the cost of additional programs to lower an already low accident rate?

An airline safety expert Cox (2011) said "SMS should give safety professionals the ability to speak the language of the financial boardroom in a way that accomplishes their safety goal."Another safety expert Flouris (2011) observed that there has been a paradigm shift for safety programs, in their design and inclination toward pro activity such as SMS. Flouris further states that "Conventional wisdom says that what safety professionals do is a cost centre … we need to start thinking of safety not in terms of cost and revenue centers, but as a value-producing centre." Flouris finally observed that "Traditional costing methods have not provided true organizational costs of safety and we have to start looking at our aviation programs as integrated organizations, not as silos".

Essentially, any activity of the collegiate aviation program and airline operations that "touches safety" should be part of the accounting at the organizational level (Flight Safety Foundation, 2011).Senior management should have a reasonably accurate prediction of the corporate-level bottom line with regards to safety initiatives as value-chain management has become a business management method highly relevant to aviation safety, one that shows the value of each input in the collegiate aviation production equation (Wald, 2010). Safety Management System would be an intrinsic part of Part 121 airline operations and collegiate aviation programs in the US for the next foreseeable future (FAA , 2012).

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